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## The Manual of Meteorology, Vol. I. Meteorology in History*

By E. VAN EVERDINGEN

If I remember well, Sir Napier told us on a certain occasion that he had written Part IV. (Vol. IV.) of this *Manual* in reply to the simple question: If the wind at the surface is given, what is the wind in the upper air? According to the preface of Vol. I., a more complicated problem presented itself here, and the author wants this Volume, (1) to serve as a textbook for students of meteorology; (2) "to present the study of meteorology not only as making use of nearly all the sciences and most of the arts, but also as a world study of a special and individual character going back inevitably to the very dawn of history . . . ," and looking forward to the advantages to be derived from modern science; (3) to serve as a stimulus for the scientific activity in meteorology on the part of the amateur.

It is not surprising that the size of the volume has grown accordingly, and yet the author has come to the conclusion that the thing really wanted would be an encyclopædia or dictionary in ten parts, one part to be brought up to date each year. That may be true, but we think many readers will prefer the present system, in spite of the fact that every condensation is to a certain extent arbitrary and must leave some categories more or less disappointed; the admirably clear way in which the problems

* By Sir Napier Shaw, LL.D., Sc.D., F.R.S., with the assistance of Elaine Austin; 8vo. 10½×7½, pp. xx+339, *Illus.* London: Cambridge University Press, 1926. 30s. net.

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are indicated, the many reproductions of historical documents or typical diagrams and maps and the numerous references to the literature of the subject must cause this *Manual* to be looked upon as a treasure by all categories.

Chapter I., " Meteorology in European Culture," sketches the fluctuations in the interest attached to weather influences and to the study of the weather from the earliest times to the present moment, and the spreading of civilisation from ancient Egypt, nearly independent of " weather," over Europe where these influences are more and more important, so much so that for the author " weather " seems to be identical with changeable or bad weather (" Egypt, a genial climate and *no* weather.")

The following Chapters, II.-VII., together about 100 pages, and devoted to the history of meteorology before the invention of the barometer, therefore start with a description of Weather and Climate in the world as known to the ancients—but Chapter II. serves another useful purpose in explaining international weather symbols, instrumental and non-instrumental observations, and concludes with climatological tables for twelve stations round the Mediterranean with Richmond for comparison. An unusually large space is devoted to frequency of winds in four quadrants and moisture. Chapter III. gives a very thorough treatment of the measurement of time and the kalendar, enabling the correlation of old climatological data with the present kalendar, and ends with kalendar-reform and a recommendation of the May-year. No mention is made of the practice in many meteorological quarters to take December to February as the winter-season and so on, for which practice similar advantages may be claimed without the disadvantage of eliminating the month as a unit. Chapters IV.-V. illustrate applications of meteorology to agriculture and navigation by quotations from poets and historians and from Aristotle, the time-scale being indicated at the head of these Chapters by names and life-periods of classical authors or the times of origin ascribed to bible-books. In the same way Chapter VI. on the variability of the Mediterranean climate is headed by a list of geological periods or maxima and minima of rainfall and storminess according to Brooks, Brückner and Pettersson. The author's conclusion is that there is no evidence of a big variation in this climate, the diminution in the cultivated area being partly due to the irreversible action of transport of sand and soil. Chapter VII. deals with weather-lore, astrology and almanacs and is very effectively headed by the poem by Erasmus Darwin (translated in various languages), giving 35 signs of rain in 42 lines. The " wholesale adoption of previous ideas " by various writers is here taken as an indication that the maxims were in reasonably good accord with their experience—it might be ascribed likewise to a lack

of experience and of trustworthy statistics. Sir Napier mentions the small number of attempts to verify the signs quoted for instance in connexion with the popular belief in the moon as weather-agent. Here van Bebber's " Handbuch der ausübenden Witterungskunde " and the literature on Falb's prognostics might have been quoted. The chapter concludes with the prospect of a certain justification of astrology through recent hypotheses on the influence of the planets on sunspot-activity.

Chapter VIII. " The reign of the barometer as weather-glass : Pioneers in the science of weather," is headed by the dates of the invention of the barometer, the gaseous laws, the laws of gravitation and motion and the law of conservation of energy and the discovery of the variation of temperature with height, the combination of the aspects of the laboratory with those of the atmosphere as a whole, necessary for the development of meteorology as a science. A sketch of this development is given in the form of 74 biographical notes from Bacon and Galilei to Mayer and Ferrel, Désains and Secchi, 24 among these treating of authors who wrote on meteorological theory. The sketch is completed by a list of the classical papers selected for reprinting by Hellmann. The use of the barometer and weather glass is illustrated by giving FitzRoy's instructions in detail. As a warning, a series of weather-maps is printed, indicating an increase of the wind at a certain station from light to gale force without any change in the barometer—only an example of the many instances in which local observations, however accurate, will fail to solve a problem which can only be approached by deriving the laws of the general circulation from an observation of the whole atmosphere as far as accessible. This leads up to Chapter IX., " Meteorology as an international Science : the Meteorological Library." The historical line is continued by mentioning the successive Chiefs of the more important meteorological Institutes all over the world, and the Officers of the International Meteorological Organisation : it is illustrated by many portraits of famous meteorologists and two Conference-groups.

The first proposals for a Réseau Mondial mark a new era, and international co-operation has been improved continuously—the author's view of the future is expressed as follows :—

> " This (the next) step certainly involves an international weather-office with adequate funds to initiate and mantain observations which are not part of the economic necessities of any special country. . . Hence we arrive at the idea not merely of an international bureau . . . but of a real international meteorological college where the meteorology of the globe can be studied and developed under conditions necessary for real success."

Chapters X. and XI. describe the Meteorological Observatory for the Surface Air and the Upper Air, the former preceded by an international list of instructions to observers, the latter by dates ranging from the first thermometer raised by kites in 1749 to the first pilot balloon ascent in 1909 and the portraits of physicists and meteorologists associated with upper air research.

The instrumental equipment of a modern surface-air observatory is described in detail, and the difficulties of reduction to standard exposure are mentioned. Reference to continental methods might have been more complete.

Cloud forms are discussed as an introduction to upper air research and represented by no less than 74 pictures, generally very well selected from various sources. In addition to the 10 international classes, lenticular clouds, cirro-nebula, alto-cumulus castellatus and pallio-nimbus are specially mentioned. A classification is proposed comprising unit-clouds, parts of these, assemblies (disorderly or in lines), one or two systems of parallel lines, stratified clouds and cloudiness without boundary.

Subsequent paragraphs treat measurement of cloud height and cloud motion, meteorological optics, pilot balloons and the various methods for upper air soundings, among which, however, the use of aeroplanes does not receive the attention which the present widespread application deserves.

Chapter XII., "The Meteorological Laboratory," is devoted to the instruments for exploring the energy changes in the atmosphere, measurement of radiation and relation of energy to wave-length, and includes visibility, dust counters, lightning conductors, atmospheric electricity and terrestrial magnetism.

Chapter XIII. discusses arithmetical and graphical manipulation of observational results, projections, logarithmic scales, isopleths, nomograms, wind-roses and vector-diagrams, periodicity and correlation. Chapter XIV. on "The Analysis of Air-movement into the General Circulation and the Cyclone" is headed by the dates of the first regular weather maps in various countries. The history of the development of synoptic meteorology is only briefly discussed, the reader being referred to Hildebrandsson and Teisserenc de Bort's *Les bases de la météorologie dynamique* for more detail. However, the reproduction of the first weather maps by Brandes (1820) and Buys Ballot (1852) and of two of the first British weather maps (1861 and 1863) is sufficient to give an idea of the progress which has been made since then.

The last, Chapter XV., "Meteorological Theory in History" is not much more than an index of memoirs, contained in Cleveland Abbé's translations of papers on dynamical meteorology, *Mémoirs originaux*, selected by Marcel Brillouin, and a few others, selected by the author. The general remark is made that many of these theories have contributed little to the

development of our science because the authors chose the conditions such that they would fit their equations, instead of trying to describe the motion in such a way that the forces would be deduced from it.

From our brief sketch of the contents of this remarkable book it is evident that it covers the entire domain of meteorology, but that the history of the dawn of that science is treated more fully than its recent development, a more ample discussion of meteorological theory being reserved for Vol. III. The meteorological world is waiting anxiously for this volume, especially after the exposition of the principles which Sir Napier has laid down in this volume—may it be given to him to complete the whole work before long!

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## The Effects of Changing Temperature on the Readings of a Marine Barometer

By E. G. BILHAM, B.Sc., D.I.C.

When the readings of a barometer are corrected for temperature, it is necessary to assume that the mean temperature of the barometer is the same as that indicated by the attached thermometer, the latter having been corrected for any known thermometric error. When conditions are absolutely steady, there is no doubt as to the validity of this assumption. When the external temperature is changing, however, the temperature of the mercury, the tube, the case and the attached thermometer may all be different and there is, moreover, an additional complication due to the fact that marine barometers are fitted with capillary tubes or constrictions in order to damp the movement of the mercury. It is a matter of some importance, therefore, to ascertain (A) what sort of errors may occur, (B) what type of attached thermometer gives the nearest approach to the truth, when the temperature is changing.

The problem arose, primarily, in connexion with the design of the Gold correction slide for marine barometers. As this instrument may not be familiar to many readers of the *Meteorological Magazine*, some particulars of its construction will be given. It is well known, of course, that the readings of a mercurial barometer normally require correction for temperature, gravity, height above sea level and index error. If we assume for the moment that the index error is zero, it is clear that the corrections for gravity and height can be expressed in terms of equivalent variations of temperature. For example, raising a barometer 27 feet lowers the readings by one millibar, and exactly the same effect would be produced by cooling the whole barometer by about 6° C. Similarly, a change of latitude from 45° to 34°

is approximately equivalent to cooling the barometer 6° C. Now consider the attached thermometer. The ordinary process consists in reading the temperature and applying a correction, but it is clear that a scale of millibars could be provided to give the correction directly. In the Gold slide such a scale is provided and arrangements are made for moving it up or down to take account of the height and latitude. In this way the total correction may be read off opposite the top of the mercury in the attached thermometer without reference to tables. The instrument is supplied as a complete unit for attachment to a marine barometer in place of the ordinary attached thermometer, provision being made for making the necessary adjustment for index error.

It will be realised that there are important differences in design between the ordinary attached thermometer and the Gold slide. In the former, the bulb usually passes through an opening in the brass case of the barometer and lies fairly close to the barometer tube. In the latter, the bulb is more or less embedded in the substantial brass stock, and it might be expected, therefore, that there would be differences in the rapidity of response to variations of temperature. The experiments now to be described were made for the purpose of ascertaining what differences existed and which type of instrument gave the best results.

In the first experiment, two marine barometers, A.247 (with Gold slide) and A.301 (with ordinary attached thermometer)

| Time from Start Minutes. | Room Temperature | Temperature by Gold Slide (G) (A.247) | Temperature by attached thermometer (A) (A.301) | G — A |
|---|---|---|---|---|
| 0 | 292·4a. | 306·3a. | 306·3a. | 0 |
| 2 | | 304·4a. | 302·5a. | 1·9a. |
| 4 | | 302·8a. | 300·7a. | 2·1a. |
| 6 | 292·6a. | 301·6a. | 299·5a. | 2·1a. |
| 8 | | 300·3a. | 298·3a. | 2·0a. |
| 10 | | 299·4a. | 298·1a. | 1·3a. |
| 12 | 292·9a. | 298·7a. | 297·7a. | 1·0a. |
| 17 | 293·3a. | 297·3a. | 296·8a. | 0·5a. |
| 22 | 293·3a. | 296·0a. | 295·9a. | 0·1a. |
| 32 | 293·3a. | 295·0a. | 295·0a. | 0 |
| 42 | 293·5a. | 294·1a. | 294·6a. | —0·5a. |
| 57 | 293·5a. | 293·5a. | 294·1a. | —0·6a. |
| 72 | 293·5a. | 293·5a. | 293·8a. | —0·3a. |
| 87 | 293·4a. | 293·4a. | 293·6a. | —0·2a. |

were placed in a small room which had been warmed to a temperature of about 307a. and allowed to remain there for an hour to ensure that conditions had become uniform. They were then quickly and simultaneously transferred to an adjoining room,

free from draughts, in which the temperature was initially 292·4a. Readings of the Gold slide thermometer on A.247 and of the attached thermometer of A.301 were then taken, first at intervals of one minute, subsequently at longer intervals, until both had reached final steady values. The results are summarised in the above table.

These results are distinctly remarkable and offer some features which are not easy to explain. In particular, the intersection of the cooling curves at 295·0a. is noteworthy. It seemed reasonable, however, to conclude that the Gold slide was less susceptible to rapid variations of external temperature than the ordinary attached thermometer, and was, therefore, likely to be a better index to the true barometric temperature. To test this conclusion, another experiment was made. The barometers were carefully compared with a standard barometer and then placed in the warming chamber, where, after a temperature of about 307a. had been maintained for about an hour, they were allowed to cool for fifteen minutes, the heat having been turned off. They were then brought into the cool room and readings both of the barometers and thermometers were taken at intervals. Each reading was reduced by the ordinary methods to the same conditions as the standard barometer (which was in a room on the floor below) and corrections were applied for index error. The reduced readings obviously constitute data from which the errors associated with the two types of thermometer may be compared. The results were as follows :—

| Time from Start | A.247 (with Gold Slide) | | | A.301 (with attached thermometer) | | |
|---|---|---|---|---|---|---|
| | Temperature | Barometer as read | Barometer Reduced | Temperature | Barometer as read | Barometer Reduced |
| min. | °a. | mbs. | mbs. | °a. | mbs. | mbs. |
| 15 | 301·3 | 1018·0 | 1016·2 | 300·7 | 1018·2 | 1016·5 |
| 17 | 300·3 | 1017·9 | 1016·2 | 299·1 | 1018·2 | 1016·7 |
| 19 | 299·5 | 1017·7 | 1016·2 | 298·5 | 1018·1 | 1016·7 |
| 22 | 298·5 | 1017·6 | 1016·2 | 297·8 | 1018·0 | 1016·8 |
| 24 | 297·7 | 1017·6 | 1016·4 | 297·4 | 1017·7 | 1016·5 |
| 26 | 297·4 | 1017·5 | 1016·4 | 296·9 | 1017·6 | 1016·5 |
| 28 | 296·6 | 1017·4 | 1016·5 | 296·7 | 1017·6 | 1016·6 |
| 30 | 296·4 | 1017·3 | 1016·4 | 296·4 | 1017·5 | 1016·5 |
| 32 | 296·2 | 1017·2 | 1016·2 | 296·2 | 1017·4 | 1016·4 |
| 37 | 295·2 | 1017·0 | 1016·2 | 295·2 | 1017·2 | 1016·4 |
| 42 | 295·0 | 1016·9 | 1016·2 | 294·9 | 1017·1 | 1016·4 |
| 47 | 294·5 | 1016·9 | 1016·2 | 294·6 | 1017·0 | 1016·3 |
| 52 | 293·9 | 1016·9 | 1016·3 | 294·2 | 1016·9 | 1016·3 |
| 57 | 293·6 | 1016·8 | 1016·3 | 294·1 | 1016·8 | 1016·2 |
| 62 | 293·6 | 1016·6 | 1016·1 | 294·0 | 1016·6 | 1016·0 |

Reading of Standard (corrected for index error) = 1016·0 at 289·2a.

It will be seen that in both cases the reduced readings are too high, due to the fact that the thermometers were cooling more rapidly than the mass of the barometer. The errors are smaller in the case of the Gold slide, however, and it seems justifiable to conclude that a thermometer mounting of massive type and high thermal capacity is by no means disadvantageous. Another point to notice is that the errors are at a maximum from 20 to 30 minutes after cooling has begun. If, therefore, a barometer is brought from a warm room into a cold room, it is better to take a reading immediately than to wait half an hour. It is better still to wait an hour as conditions will have reached a steady state after that interval.

## Official Publications

GEOPHYSICAL MEMOIRS—

No. 35. *A Comparison of the Records from British Magnetic Stations, Underground and Surface.* By C. Chree, Sc.D., LL.D., F.R.S., and R. E. Watson, B.Sc. (M.O. 286e).

Since March, 1918, a weekly bulletin has been published of two-hourly values of magnetic declination (pointing of the compass needle). Until the end of 1924, this was based on the records at Kew Observatory. The object of the present investigation was to shed light on the question of how far data from a station in the south of England are serviceable in other parts of Great Britain, especially in the mining areas. Results obtained in 1923, underground and at the surface of a coal mine at Sandwell Park, near Birmingham, are compared with synchronous results from Kew, Eskdalemuir and Lerwick observatories. A general tendency is observed in declination changes to increase in size as we go north. The increase in the regular changes on quiet days is small and near mid-winter may even become a decrease. But on highly disturbed days, or even on quieter days in the case of short period changes, the increase with latitude is rapid. The changes observed in the intensity of the horizontal force at Lerwick sometimes differed immensely both in amplitude and type from those elsewhere.

## Royal Meteorological Society

The last monthly meeting of the Society for the present session was held on June 15th, at 49, Cromwell Road, South Kensington, Sir Gilbert Walker, C.S.I., F.R.S., President, in the Chair.

*J. Edmund Clark, I. D. Margary and R. Marshall.—Report on the Phenological Observations in the British Isles, December, 1925 to November, 1926.*

The thirty-sixth report of the new series deals with 373 sets

of records, a number greater than in any previous year. Yet large areas remain very meagrely represented, particularly the western halves of Ireland and Scotland, and all Scotland north of Inverness. Fresh observers in these districts would be warmly welcomed. Increasing public recognition of the interest and value of the work is evidenced by the co-operation of the Ministry of Agriculture, the response to the appeal for international work, and the fact that the first of six popular talks on Meteorology broadcasted from 2LO, was by Mr. Margary on Phenology and has brought in many valuable enquiries. The Report sketches the history of the Royal Meteorological Society's work from its inception in 1875 under the Rev. F. A. Preston, of Marlborough College, its re-organization in 1891 by Mr. E. Mawley, and its gradual development along the lines laid down by him. The present report shows that the five weeks cold spell preceding Christmas, 1925, retarded the first indications of the new season's growth, but this was quickly neutralised by warmth equally abnormal, culminating in the closing week of winter and continued on to give that most acceptable burst of summer at Easter. In consequence flower, bird and insect records were very early up to mid-April, notable being those of the arrival of cuckoo and swallow and flowering of hawthorn. Then everything was retarded by a prolonged spell of cold, worst about mid-May, injuring the fruit crop, particularly apples. June was cool and very dry and in many parts July brought a deluge. Yet in the end, field crops cheered farmers, being helped by a dry summer and fairly warm August, warm September and early October. Grain expectations however failed of full realisation upon threshing. Destructive mid-October frosts damaged late potatoes and practically wiped out autumn colouring. Very striking were the many records of the return after this of swallows and housemartins, often lingering all through November and in some cases into December.

*G. C. Simpson, C.B., D.Sc., F.R.S.—Past Climates.*

The paper discusses from the meteorological point of view the possible changes in climate which can be brought about by changes in the physical condition of the earth's surface—chiefly changes in the extent and distribution of the land masses and changes in their height—unaccompanied by any variation in solar radiation. It is shown that the zonal distribution of temperature cannot be materially changed and that there must always have been a cold polar zone, a warm tropical zone and an intermediate temperate zone, all very similar to those which exist to-day. Further a detailed examination of the existing variations in mean annual temperature along various circles of latitude leads to the conclusion that no rearrangement of land and water could have produced larger variations of mean annual

temperature than are to be found in the northern hemisphere to-day. A discussion of the existing sheet of inland ice which covers Greenland gives good reason for believing that the ice sheet which covered northwest Europe during the last great ice-age could not have been caused by the elevation of Scandinavia. Finally a discussion of the present conditions in tropical regions, where in the coldest parts the snow-line is to-day more than 5,000 metres above sea-level, leads to the conclusion that ice could never reach sea-level within the tropics.

*H. M. Treloar, B.Sc.—The Variation of Eddy Viscosity with Wind Velocity and Season. A study based on pilot balloon observations at Melbourne.*

## Correspondence

To the Editor, *The Meteorological Magazine*

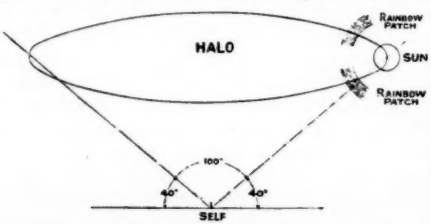
### Halos in India

After reading your note about the parhelic circle, in the *Meteorological Magazine* for March 27th, p. 41, I have looked through the collection of optical phenomena in our annual publication. I find six or seven cases in 35 years in which part of the parhelic circle was seen without the common halo of 22° being visible, sometimes a tangent arc being present, sometimes a vertical column. But when the parhelic circle extended over a considerable azimuthal distance, always the ordinary circular halo was present also, as may be easily explained. Does the case quoted by you form an exception? Your correspondent does not say so in the extract of his letter. If he does not mention the ordinary halo it may be because that did not want any explanation.

E. VAN EVERDINGEN.

*Koninklijk Nederlandsch Meteorologisch Instituut, De Bilt. April 2nd, 1927*

[In view of Prof. van Everdingen's evidence for the uniqueness of the phenomenon, we reproduce Mr. Sheriff's sketch. It will be seen that there is no indication of the occurrence of a circular halo round the sun. Moreover, the description "patches of rainbow" is appropriate for parhelia rather than for little arcs of the 22° halo.—ED. *M.M.*]



## Lightning Discharges

In the *Meteorological Magazine* for June, 1927, you published a letter from Professor McAdie in which he described the work of Mr. F. W. Peek, Jr., on "Lightning and other High Voltage Phenomena." Mr. Peek comes to the conclusion that the energy of a lightning discharge is 3·8 kilowatt hours; that is "sufficient to operate an electric toaster for a day." This estimate is so widely different from the one made by Professor C. T. R. Wilson* and generally adopted by workers in atmospheric electricity that attention must be called to the discrepancy. Professor Wilson, on sound physical reasoning, estimated the average energy of a lightning discharge to be 2,800 kilowatt hours, which is more than 700 times the value estimated by Mr. Peek. One lightning flash an hour, on Professor Wilson's estimate, would provide all the electrical power required by a modern industrial city of 100,000 inhabitants—24 million British thermal units per annum—thus a large generating station is more suitable for comparison with a thunderstorm than an electric toaster.

May I also point out that Mr. Peek's experiments on the chances of being struck by a lightning flash were made before the physics of a lightning flash had been worked out.† Mr. Peek does not differentiate between discharges from positively and negatively charged clouds, and his estimate of 300 metres as the height at which lightning discharges start is very much too low. Recent work indicates that in this respect also Mr. Peek's experiments are not satisfactory guides to the actual phenomena of thunderstorms.

G. C. SIMPSON.

*June 25th, 1927.*

## The Gale at Tiree

The reading of 108 m.p.h. obtained at Tiree‡ on January 28th last within a few months of the commencement of wind records in the island was of exceptional interest and made one wonder whether the new station was going to beat all previous records for high winds. Some interesting light is thrown upon this point by the very large number of uprooted trees which have been noticed in the Loch Fyne and Oban districts during the course of a trip up the west coast of Scotland. The extent of the damage and its wide distribution shows that it was not the

* "Investigations on Lightning Discharges and on the electric field of thunderstorms," by C. T. R. Wilson.' *London Phil. Trans.* A. Vol. 221, 1920, p. 73.

† "On Lightning." By G. C. Simpson. *London Proc. R. Soc.* A. Vol. 111, 1926, p. 56; and "The Mechanism of a Thunderstorm." By G. C. Simpson. *London Proc. R. Soc.* A. Vol. 114, 1927, p. 376.

‡ See *Meteorological Magazine* 62 (1927), p. 70.

result of an isolated squall or a localized high wind; evidently a wind of quite unusual strength swept across this belt of country sometime during the past winter. It thus appears probable that there is no reason to anticipate a frequent repetition of similar high readings from Tiree.

J. S. DINES.

*Kyle of Lochalsh. May 31st, 1927.*

### Grass Minimum Temperatures

With regard to your note in the May number, about local variations in grass minimum temperatures, you may be interested in the undermentioned observations, taken near Godalming, (A) from a position near bushes, etc., and (B) from a depression of about two feet in very open ground, about 60 yards away. The latter position is in a kind of furrow in heath land, otherwise no lower than (A), where fern is often cut by frost while that around is untouched. The thermometers read the same when placed side by side.

| Date | (A) | (B) | Screen Minimum. |
|---|---|---|---|
| April 30th—May 1st .. | 19° | 8° | 29° |
| May 22nd—23rd.. .. | 25° | 17° | 34·5° |

G. WESTON.

*38, Chester Terrace, S.W.1. May 23rd, 1927.*

## NOTES AND QUERIES

### The Weather of the Eclipse

The early morning of June 29th, when the total eclipse of the sun took place, was generally cloudy over the whole of the British Isles. The previous evening the skies had cleared somewhat giving rise to the hope that an interval of fairer weather would coincide with the time of the eclipse but a depression over the north of Scotland was moving slowly southwards and was centred over Ireland at 7h. G.M.T. on the 29th. There was a considerable increase in the amount of cloud during the night and in numerous places in the south and in Wales rain was falling at the time of the eclipse. In the region of totality however there were many breaks in the cloud layer, for example, the Town Clerk of West Hartlepool writes in the *Times* that "At West Hartlepool watchers were sadly disappointed for at the moment of totality the sun failed to emerge from behind the banks of dense grey cloud but an excellent view was obtained by hundreds of observers on the uplands from 1 to 3 miles inland and westward from the town." Equally variable conditions prevailed over the whole of northern England and southern Scotland. At Southport and other towns in the west mist partially obscured the view. Owing to the dense clouds and to the fact that the time of

eclipse occurred so shortly after sunrise the effects of the eclipse on the general meteorological conditions, of which an account was given in the May number of the *Meteorological Magazine*, p. 77, were considerably less than during past eclipses. Mr. Seton Gordon, of Inverness-shire, writes that on the Cairngorms, where there was a thin mist at 3,000 ft., the view of the eclipse was excellent and the temperature fell from 38° F. to 33° F. in 15 minutes, rising again to 35° F. in the next ten minutes.

Mr. Baxendell, of Fernley Observatory, Southport, who was carrying out a programme of meteorological observations during the eclipse has sent the following report :—

" The weather outlook had really appeared hopeless, but, as by a miracle, the clouds dispersed in time, and, after one alarming temporary return, cleared quite away just before the most important period, and kept off until they did not matter. But the sky was remarkably misty—one could not call it smoke-hazy, it appeared far more ' watery ' than ' brownish '—and though the solar corona and two prominences were so bright that the view was most gratifying to everyone but the astronomers, all the meteorological effects of the eclipse were ' watered-down ' deplorably, those upon wind being the only ones really well shown. Throughout the entire morning there was no trace of any charring of the card of the sunshine recorder. We do not possess a micro-barograph, but our open-scale Dines barogram shows no variations that can be attributed with the slightest certainty to the eclipse.

" In Hesketh Park (amongst trees) the large Dines thermograph only fell 0·2°, and the daily-pattern Richard hair hygrogram was a straight line. At a special station on the foreshore, the daily-pattern thermogram, contained in a Stevenson Screen, showed a total fall of only 0·4°, and the daily-pattern hair hygrogram a minute increase of less than 1 per cent. of relative humidity. The really useful results were those obtained (at the Marshside Anemograph Station) by means of the three special instruments kindly lent by the Meteorological Office. The Assmann psychrometer readings showed a fall of air temperature of 0·9°, and of evaporation temperature of 0·6°, the minimum in each case occurring at, I think, almost exactly 5.34 G.M.T., and the readings then being Dry=47·9° ; Wet =47·0°.

" The wind effects are very well shown on the autographic records from the ' quick-run ' instruments. But the wind was so light that, but for our exposure and sensitive instruments, they could not have been secured. The falling-off, and after-the-event recovery, of ' mean wind ' speed, was only 2 or 3 m.p.h. A 6 m.p.h. wind dropped to 4 m.p.h. at 5.28 or 5.29, and then returned to 6 m.p.h. The greater steadiness of the wind during

the important time was well marked. The effect of the central part of the eclipse on wind direction was even more obvious. From a direction of about 146°, the wind backed to 118° at 5.30, returning afterwards (by about 5.47) to nearly the former azimuth.

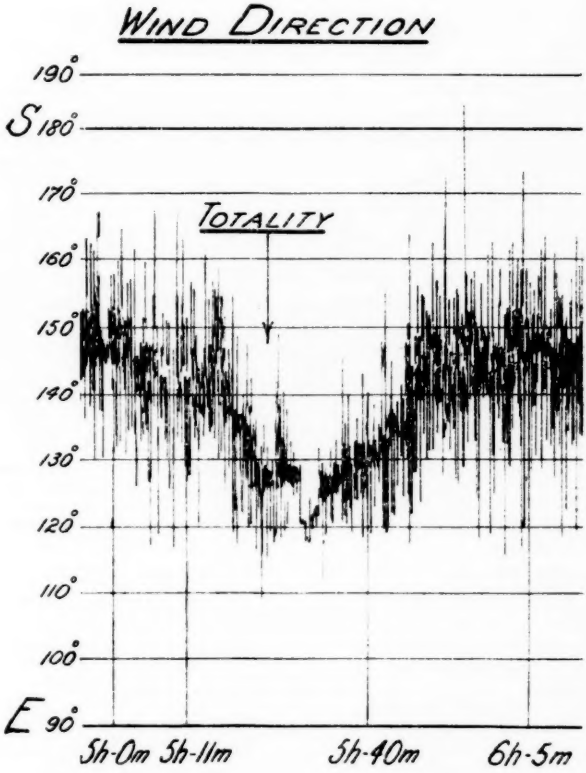
"I am sure the wind extremes occurred a few minutes before those of temperature and humidity. The lag of both, as compared with totality, was doubtless due to the wind having come to us over nearly as much land as is possible in England, instead of off our sea.

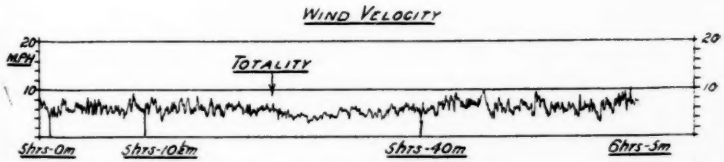
"There was no defined front to the moon's shadow, but many thought it very dark, though I did not. The indigo tint of the blackness on the sky was very decided. I could see no 'shadow bands' whatever. The sky haze later become worse, resembling the volcanic dust summer of 1912, but whiter."

The records of wind speed and direction obtained at Southport during the eclipse are reproduced. It may be noted that the duration of totality at Southport was about 23 seconds and that the time of totality there was 5h. 24m. G.M.T.

Mr. E. W. Barlow, who was observing at Colwyn Bay, writes that:—

"The morning of June 29th was heavily overcast at Colwyn Bay and intermittent light rain fell so that no direct observation of the sun was possible. My observing station, at a height of some 300 feet above sea level in private grounds, commanded a view from Snowdonia to the Lancashire coast, but in spite of the open situation there was, with one exception, no perceptible air movement during the time I was out, from 5h. to 7h. 30m. B.S.T. The exception constituted a striking gust occurring about half-an-hour after first contact, lasting only two or three seconds and developing a velocity estimated at 7-10 miles per hour. It thus had similar characteristics to the eclipse gusts observed on previous occasions. The coming of the shadow at totality was very impressive. Up to this time the decrease of light was less than I expected; the shadow rose quickly in the south as a dark mass of clear indigo colour. As it swept over, darkness fell with extreme suddenness. Ten to fifteen seconds later the returning light was observed coming from the south-west, of a golden-grey colour in distinction to the general smoke-grey colour just previous to totality. A little later the shadow left us with the suddenness of an electric light being switched on and from thence daylight increased rapidly. There was a complete absence of the vivid coloration experienced at most eclipses probably owing to the thickness of the cloud layer, the under surface of which was at an altitude of 2,000 to 2,500 feet. The darkness of totality was considerable, only the nearer parts of the landscape remaining visible."




AUTOGRAPHIC RECORDS, SOUTHPORT, JUNE 29TH, 1927.

## A Wind Spout at Lindenberg.

The following interesting notes have been translated from the Report of the Lindenberg Aeronautical Observatory for August, 1926.

During the afternoon of June 4th, 1926, the short powerful cone of a wind spout made its appearance at the south end of a thick bank of cumulus, which spread over Lindenberg from south to north, and from which a few big rain drops had fallen a few minutes previously. I noticed the cone shortly after its formation just as I was going to move away from the distance meter with which the cloud measurements given below had been effected. As the distance meter had already been adjusted for all kinds of measurements, I was able at once to take reliable measurements of the wind spout. The following values were obtained :—

| Time. | Distance of centre of cone. | Corresponding angle of elevation. | Altitude of this point above the ground. | Azimuth of this point. | Horizontal distance. |
|---|---|---|---|---|---|
| h. m. | metres | ° | metres | ° | metres |
| 18 00 | 1,970 | 23·5 | 780 | 181 | 1,820 |
| 18 03 | 2,100 | 20·3 | 730 | 169 | 2,000 |

Azimuth angle 180° is S. ; degrees read anti-clockwise.

The apparent width of the cone and its centre were found by means of the distance meter as 1·3°. This angle corresponds at about 2,000 metres distance from the object to a diameter of the cone amounting to 50 metres.

In observing the phenomenon it was noted that the sharpness of the edge of the cone varied ; it was, however, possible to take measurements at moments when the edge showed up clearest, so that good focussing of the distance meter was possible. Five minutes after it was first noticed, the cone was slightly longer, and the low cloud which had obscured the upper part had disintegrated. I was personally unable to note any rotation of the wind spout at the outset, but Dr. Duckert noted a rotation in the final stage. For some considerable time afterwards a vortex movement of the cloud particles could be observed in the cloud in which the wind spout occurred.

The direction of travel of the wind spout was east-south-east to west-north-west. The length of the cone was estimated at 6°, which corresponds to a length of approximately 200 metres.

In connexion with the wind spout, the following cloud measurements carried out a quarter of an hour previous to the

occurrence of the phenomenon, are of interest:—

| Type of Cloud. | Distance. | Angle of Elevation. | Altitude above ground. | Remarks. |
|---|---|---|---|---|
| | km. | ° | metres | |
| Cumulus top to north-west | 7·8 | 30·8 | 4,000 | — |
| | 7·4 | 30·8 | 3,800 | — |
| | 5·75 | 21·0 | 2,060 | At outset |
| | 5·87 | 22·0 | 2,200 | After 20 secs. |
| | 5·86 | 22·9 | 2,280 | ,, 100 ,, |
| | 5·87 | 23·9 | 2,330 | ,, 150 ,, |

The last line shows an upward vertical velocity of 1·8 metres per second.

Bright summer lightning was observed to the west-south-west at 22h.

H. TROEGER.

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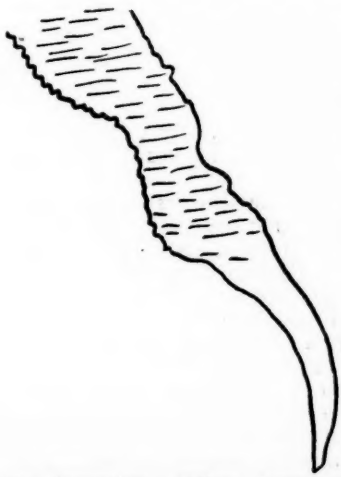
On June 4th, 1926, at 18h. 7m., Herr Troeger called my attention to a very well developed wind spout existing in a bank of cumulus cloud south of Lindenberg, which he had been observing for some time. The form changed very little at first. The sketch of the phenomenon done shortly afterwards was practically as shown in the figure.



The altitude of the lower edge of the cone was estimated at about 500 metres. The total length of the wind spout was 700 to 800 metres, and the diameter at the part indicated was about 40 metres.

The cone was surrounded by small masses of well-defined cumulus cloud. It was difficult at first to recognise any rotation of the formation. When, however, the wind spout in its path approached the cumulus cloud, I clearly saw how the scud was

torn away from the hazy-looking formation: soon the rotation of the actual wind spout could be clearly seen. About 18h. 12m. I could determine the rotation very clearly. In about 12 to 13 seconds it reached the point indicated in the figure. In an astonishingly short time a very extensive cumulus bank was completely sucked in. The path travelled by the wind spout was indicated by a particularly cloudless bit of sky, though fragments of scud were whirled about. As the rotation gradually became less marked, the disintegrating force decreased, and about 18h. 15m. the wind spout was no longer to be seen.

Dr. P. DUCKERT.

## Early Sumerian Climatology

Prof. H. v. Ficker* calls attention to a remark by Prof. Ungad that in the speech of the ancient Sumerians the points of the compass are designated as follows: East, mountain; West, rainstorm; North, wind-squall; South, cloud. From this combination he deduces that the early home of the Sumerians was in western Turkestan, which has just that geographical and climatological combination. The mountains to the east are the high Pamirs; the north wind brings cold waves from the Arctic but no rain, while the south wind brings cloud over the mountains of Afghanistan to the south, but is felt in the plains as a dry Föhn-like wind. Only the west wind brings rain. Prof. Ficker remarks that the designations for north, south and west constitute a climatography of West Turkestan "of a brevity foreign to most climatological treatises."

## Review

*Observing Water-surface Temperatures at Sea.* By C. F. Brooks. Washington, D.C., M.W. Rev. June, 1926. Vol. 54. pp. 241-254.

When meteorological observations at sea were first systematised by Maury in 1851, it was laid down that the temperature of the sea surface should be obtained by dipping a canvas bucket over the side of the ship and observing the temperature of the water so obtained. In those days when ships had low freeboard, the interval from the drawing of the water to the reading of the thermometer was short, but with a modern ship the drawing up of the bucket to a height of 65 feet or more affords time for any errors introduced to be multiplied. Dr. Brooks in this paper delivers a general attack on this method. From observations made in the *Empress of Britain* during a cruise to the West Indies in the spring of 1924 he arrays a mass of statistics which

* Klimatologische Bemerkungen über Turkestan. By H. v. Ficker, *Leipzig, Mitt. Ges. Erdk.*, 1925, *p.* 42.

shows conclusively that errors are frequently made in these observations of the order 2° F. or more. He then discusses to what these errors are due and concludes that probably the most important source of error is the cooling by evaporation from the wet surface of the bucket. Dr. Brooks, however, proposes radical changes in the procedure of taking sea temperatures which he maintains will lead to more satisfactory results. He proposes that the water should be drawn from over the stern of the ship (where the haul is comparatively short) and in a metal bucket, but as an alternative (to which he shows marked favour) he suggests that thermographs should be connected to the water flowing through the condenser intake of the ship's engines.

It is natural that this latter method should be criticised on account of the depth from which the condenser intake draws its water, since to the meteorologist the temperature of the surface film of the sea is of interest only. The author of the paper, however, concludes that the condenser intake will show the true surface temperature in winter and in windy weather at any season when the mixing of surface layer is vigorous, and that in summer its indication will differ from surface temperatures by no more than 0 to 0·6° F. on the average, with an error of 2° F. not oftener than about 2 per cent.

C.S.D.

## News in Brief

Mr. G. B. Hamlin, of Burlow, Horeham Road, Sussex, reports that there was continuous rain there for 17·8 hours on July 1st and that between 3h. 10m. and 18h. 30m. he recorded 57·7 mm.

The expedition, planned by Dr. Dumbrava, under the patronage of the French and Belgian Royal Geographical Societies, with the object of making a general study of the east coast of Greenland, its inland ice fields and its meteorological conditions, will sail from Copenhagen in the middle of July on a Danish Government boat for Angmagsalik, which will be its base for the sixteen months the expedition proposes to be in Greenland.

Following on two or three vivid flashes of lightning during a thunderstorm in Sheffield on June 27th, a "thunderbolt" fell in Scotland Street, throwing off sparks as it came down and striking the earth with a loud explosion.

With this number the measurements of rainfall in the Climatological Table for the British Empire are expressed in inches

instead of in millimetres. The column of millimetres is also omitted from the Rainfall Table for the British Isles.

## The Weather of June, 1927

The weather of the month was generally unsettled and cool, except for a short period around the 16th in southeastern England when temperature rose above 80° F. For the first fortnight cool, rather unsettled thundery conditions prevailed with many bright periods but occasional local heavy rain; 1·48 in. fell at Banbridge (Down) on the 7th, and 1·44 in. at Mount Callan (Clare) on the 9th. In most districts, however, rainfall during this period was below the normal and in some places there was extremely little. Sunshine was variable; at Inchkeith more than 16½ hours were recorded on the 14th. Temperature in the screen fell to 32° F. or below at a few Scotch stations while ground frosts occurred at several places in various parts of the country, the lowest ground temperature recorded being 23° F. at Eskdalemuir on the 10th, at Balmoral on the 11th, and at Rounton on the 15th. On the 16th a deep depression was situated over the Atlantic and a shallow depression over the western Mediterranean. In consequence the air over south-eastern England was drawn from the Mediterranean region and some high temperatures were recorded; the highest maximum, 85° F., occurred in London. Elsewhere much cloud prevailed with heavy rain locally, 1·53 in. at Carnarvon, 1·48 in. at Mary Tavy (Devon), 1·35 in. at Douglas, and 1·30 in. at Crieff. From the 16th onwards the character of the weather changed to a more disturbed type. Depressions moving across the country brought high winds and local gales with heavy rain at times. Wind force 9 (50 m.p.h.) was reported from Inchkeith and Malin Head on the 21st, and from Pembroke on the 24th, while a gust of 71 m.p.h. was recorded at Paisley on the 21st. Noteworthy rainfall was registered at Eskdalemuir on the 18th between 17h. and 18h. when 0·23 in. fell in 6 minutes, and 0·34 in. in 10 minutes. After the 27th the winds decreased in force but a complex system of low pressure areas continued over the British Isles causing much rain, among the heaviest falls being that of 1·90 in. at Tottingworth Park, Sussex, on the 30th.

Pressure was below normal over western Europe except for Spain and Italy, the greatest deficit being 6·2 mb. at Florö and 6·1 mb. at Aberdeen, and above normal over the North Atlantic from Spitsbergen and Iceland to the Azores and Bermuda. There was also an area with pressure below normal over Newfoundland and Nova Scotia. Temperature was below normal and rainfall above normal generally except for the extreme

southwest. In northwest Gothaland (Sweden) the rainfall was three times the normal.

During the first part of the month the weather over Europe was stormy and thundery. On the evening of the 1st a whirlwind swept across eastern Holland into Germany destroying everything in its path, which extended from Milligen to Tudderuen and then to Lingen and south Oldenburg. Seven people were killed. On the 2nd and 3rd violent thunderstorms occurred generally in Switzerland and south Germany, and a water-spout was observed over Morges on the Lake of Geneva. Within a few minutes of its appearance the streets were flooded to a depth of 1 foot. Owing to the storms many rivers in western Switzerland overflowed their banks and the crops were damaged. On the 9th it was reported that hailstorms had destroyed field crops and fruit in many parts of upper Austria. Severe thunderstorms also occurred in northern Italy on the 11th, and later hailstorms did much damage in White Russia. Owing to excessive rains during the latter part of the month, with intervals of summer heat, the enormous volumes of snow, which at midsummer still lay on the high mountains, melted with great suddenness and produced serious floods in east Norway. Five lives were lost.

Heavy rain occurred in Bombay on the 14th and 15th flooding a great part of the city, 14½ in. being recorded during the two days. Heavy rain also fell on the Ghats and at Poona but the wind was then still northerly instead of southwesterly.

During most of the month beneficial rains, bringing relief from severe drought, occurred generally in the southeast and southwest States of America, except in southern Florida. In Missouri and Arkansas the rainfall was excessive between the 15th and 21st. The new flood in the tributaries of the Mississippi in its middle stretches which began at the end of May again inundated several thousand acres in Arkansas, and the southern part of the Mississippi is still largely flooded.

The special message from Brazil states that the rainfall in the northern and central districts was scarce, being 69 mm. and 22 mm. below normal respectively, and in the southern districts copious with 78 mm. above normal. Six anticyclones passed across the country and stormy weather was experienced in south Brazil and River Plate owing to the frequent passage of low pressure areas in the south. Frosts occurred in the southern districts during the last ten days. The crops were generally in good condition. At Rio de Janeiro pressure was 0·4 mb. below normal and temperature 0·4° F. below normal.

## Rainfall, June, 1927—General Distribution

| | | |
|---|---|---|
| England and Wales .. | 163 | per cent. of the average 1881-1915. |
| Scotland .. .. .. .. | 165 | |
| Ireland .. .. .. .. | 135 | |
| British Isles .. .. .. | 158 | |

## Rainfall: June, 1927: England and Wales

| CO. | STATION. | In. | Per-cent. of Av. | CO. | STATION. | In. | Per-cent of Av. |
|---|---|---|---|---|---|---|---|
| *Lond.* | Camden Square ..... | 2·80 | 139 | *War.* | Birmingham, Edgbaston | 4·15 | 179 |
| *Sur .* | Reigate, The Knowle.. | 4·20 | 216 | *Leics* | Thornton Reservoir .. | 4·93 | 228 |
| *Kent.* | Tenterden, Ashenden.. | 4·25 | 222 | ,, . | Belvoir Castle..... | 4·33 | 227 |
| ,, . | Folkestone, Boro. San. | ... | ... | *Rut .* | Ridlington..... | 4.72 | ... |
| ,, . | Margate, Cliftonville.. | 3·53 | 202 | *Linc.* | Boston, Skirbeck ..... | 3·34 | 184 |
| ,, . | Sevenoaks, Speldhurst. | 4·30 | ... | ,, . | Lincoln, Sessions House | 2.88 | 142 |
| *Sus .* | Patching Farm..... | 3.70 | 183 | ,, . | Skegness, Marine Gdns. | 3.28 | 182 |
| ,, . | Brighton, Old Steyne . | 3·78 | 210 | ,, . | Louth, Westgate ..... | 3·30 | 153 |
| ,, . | Tottingworth Park.... | 7·20 | 129 | ,, . | Brigg ..... | ... | ... |
| *Hants* | Ventnor,Roy.Nat.Hos. | 2·28 | 125 | *Notts.* | Worksop, Hodsock.... | 2·90 | 146 |
| ,, . | Fordingbridge, Oaklnds | 2·73 | 148 | *Derby* | Mickleover, Clyde Ho.. | 4·67 | 195 |
| ,, . | Ovington Rectory .... | 3·28 | 141 | ,, . | Buxton, Devon. Hos... | 7·81 | 242 |
| ,, . | Sherborne St. John... | 3·26 | 153 | *Ches.* | Runcorn, Weston Pt... | 4·69 | 182 |
| *Berks* | Wellington College... | 2·60 | 120 | ,, .. | Nantwich, Dorfold Hall | 5·18 | ... |
| ,, . | Newbury, Greenham.. | 3·19 | 147 | *Lancs* | Manchester, Whit. Pk. | 4·72 | 179 |
| *Herts.* | Benington House .... | 3·33 | 162 | ,, .. | Stonyhurst College.... | 4·00 | 130 |
| *Bucks* | High Wycombe ..... | 3·80 | 195 | ,, .. | Southport, Hesketh I'k | 3·09 | 142 |
| *Oxf..* | Oxford, Mag. College.. | 2·94 | 138 | ,, .. | Lancaster, Strathspey. | 3·50 | ... |
| *Nor .* | Pitsford, Sedgebrook.. | 4·01 | 208 | *Yorks* | Wath-upon-Dearne ... | 2·20 | 99 |
| ,, . | Oundle..... | ... | ... | ,, . | Bradford, Lister Pk... | 3·24 | 138 |
| *Beds.* | Woburn, Crawley Mill. | 3·27 | 167 | ,, . | Oughtershaw Hall.... | 5·47 | ... |
| *Cam.* | Cambridge, Bot. Gdns. | ... | ... | ,, . | Wetherby, Ribston H.. | 2·65 | 126 |
| *Essex* | Chelmsford, CountyLab | 3·04 | 160 | ,, . | Hull, Pearson Park ... | 2·80 | 136 |
| ,, . | Lexden, Hill House... | 3·68 | ... | ,, . | Holme-on-Spalding ... | 2·59 | ... |
| *Suff .* | Hawkedon Rectory ... | 3.42 | 165 | ,, . | West Witton, Ivy Ho.. | 2·37 | ... |
| ,, . | Haughley House..... | 3·56 | ... | ,, . | Felixkirk, Mt. St. John | 3·11 | 142 |
| *Norf.* | Beccles, Geldeston.... | 4·03 | 224 | ,, . | Pickering, Hungate ... | 3·31 | ... |
| ,, . | Norwich, Eaton ..... | ... | ... | ,, . | Scarborough..... | 3·25 | 177 |
| ,, . | Blakeney ..... | 3·87 | 208 | ,, . | Middlesbrough ..... | 2·31 | 122 |
| ,, . | Little Dunham ..... | 5·37 | 240 | ,, . | Baldersdale, Hury Res. | 2·44 | ... |
| *Wilts.* | Devizes, Highclere.... | 3·02 | 134 | *Durh.* | Ushaw College ..... | 3·25 | 150 |
| ,, . | Bishops Cannings .... | 3·16 | 131 | *Nor .* | Newcastle, Town Moor. | 3·83 | 176 |
| *Dor .* | Evershot, Melbury Ho. | 2·82 | 124 | ,, . | Bellingham, Highgreen | 3·38 | ... |
| ,, . | Creech Grange ..... | 3·40 | ... | ,, . | Lilburn Tower Gdns.. | 2·61 | ... |
| ,, . | Shaftesbury, Abbey Ho. | 2·81 | 121 | *Cumb* | Geltsdale..... | 3·87 | ... |
| *Devon* | Plymouth, The Hoe... | 3·19 | 148 | ,, . | Carlisle, Scaleby Hall . | 3·61 | 143 |
| ,, . | Polapit Tamar ..... | 2·57 | 120 | ,, . | Seathwaite M. ..... | 11.01 | 169 |
| ,, . | Ashburton, Druid Ho.. | 3·24 | 127 | *Glam.* | Cardiff, Ely P. Stn..... | 3·48 | 140 |
| ,, . | Culiompton ..... | 2·76 | 130 | ,, . | Treherbert, Tynywaun | 6·27 | ... |
| ,, . | Sidmouth, Sidmount .. | 2·28 | 109 | *Carm* | Carmarthen Friary.... | 3·79 | 132 |
| ,, . | Filleigh, Castle Hill ... | 3·56 | ... | ,, . | Llanwrda, Dolaucothy. | 5·88 | 173 |
| ,, . | Barnstaple,N.Dev.Ath. | 2·21 | 99 | *Pemb* | Haverfordwest, School | 3·27 | 121 |
| *Corn.* | Redruth, Trewirgie ... | 3·56 | 143 | *Card.* | Gogerddan..... | 7·04 | 226 |
| ,, . | Penzance, Morrab Gdn. | 3·26 | 147 | ,, . | Cardigan,County Sch. . | 3·01 | ... |
| ,, . | St. Austell, Trevarna.. | 3·43 | 132 | *Brec .* | Crickhowell, Talymaes | 4·60 | ... |
| *Soms* | Chewton Mendip ..... | 4·62 | 156 | *Rad .* | Birm.W.W.Tyrmynydd | 6·72 | 205 |
| ,, . | Street, Hind Hayes .... | 2.83 | ... | *Mont.* | Lake Vyrnwy ..... | 7·25 | 229 |
| *Glos..* | Clifton College ..... | 3·38 | 136 | *Denb.* | Llangynhafal ..... | 4·89 | ... |
| ,, . | Cirencester, Gwynfa.. | 3·88 | 162 | *Mer .* | Dolgelly, Bryntirion.. | 9·28 | 267 |
| *Here.* | Ross, Birchlea ..... | 2.87 | 132 | *Carn.* | Llandudno ..... | 3·27 | 161 |
| ,, . | Ledbury, Underdown. | 3·32 | 147 | ,, . | Snowdon, L. Llydaw 9 | 16·29 | ... |
| *Salop* | Church Stretton ..... | 4·42 | 183 | *Ang .* | Holyhead, Salt Island. | 3·69 | 172 |
| ,, . | Shifnal, Hatton Grange | 4·40 | 197 | ,, . | Lligwy ..... | 4·38 | ... |
| *Staff.* | Tean, The Heath Ho... | ... | ... | *Isle of Man* | | | |
| *Worc.* | Ombersley, Holt Lock. | 3·15 | 139 | | Douglas, Boro' Cem... | 4·59 | 190 |
| . | Blockley, Upton Wold. | 3·88 | 146 | *Guernsey* | | | |
| *War.* | Farnborough ..... | 5·08 | 214 | | St. Peter P't.Grange Rd | 3·11 | 168 |

## Rainfall: June, 1927: Scotland and Ireland

| CO. | STATION | In. | Per-cent. of Av. | CO. | STATION. | In. | Per-cent of Av. |
|---|---|---|---|---|---|---|---|
| *Wigt.* | Stoneykirk, Ardwell Ho | 3·26 | 134 | *Suth.* | Loch More, Achfary | 7·30 | 197 |
| ,, | Pt. William, Monreith | 3·43 | ... | *Caith* | Wick | 2·89 | 161 |
| *Kirk.* | Carsphairn, Shiel. | 6·65 | ... | *Ork.* | Pomona, Deerness | 3·10 | 169 |
| ,, | Dumfries, Cargen | 4·43 | 159 | *Shet.* | Lerwick | 2·85 | 160 |
| *Roxb* | Branxholme | 3·08 | 137 | | | ... | |
| *Selk.* | Ettrick Manse | 4·76 | ... | *Cork.* | Caheragh Rectory | 3·22 | ... |
| *Berk.* | Marchmont House | 3·74 | 162 | ,, | Dunmanway Rectory | 3·22 | 92 |
| *Hadd* | North Berwick Res. | 2·23 | 134 | ,, | Ballinacurra | 2·40 | 92 |
| *Midl* | Edinburgh, Roy. Obs. | 2·98 | 161 | ,, | Glanmire, Lota Lo. | 3·20 | 118 |
| *Lan.* | Biggar | ... | ... | *Kerry* | Valentia Obsy. | ... | ... |
| ,, | Leadhills | 5·86 | ... | ,, | Killarney Asylum | 5·13 | 176 |
| *Ayr.* | Kilmarnock, Agric. C. | 4·84 | 220 | ,, | Darrynane Abbey | 4·16 | 132 |
| ,, | Girvan, Pinmore | 4·52 | 156 | *Wat.* | Waterford, Brook Lo. | 3·93 | 146 |
| *Renf.* | Glasgow, Queen's Pk. | 3·99 | 173 | *Tip.* | Nenagh, Cas. Lough | 4·38 | 179 |
| ,, | Greenock, Prospect H. | 4·64 | 141 | ,, | Roscrea, Timoney Park | 3·50 | ... |
| *Bute.* | Rothesay, Ardencraig | 4·80 | 156 | ,, | Cashel, Ballinamona | 3·42 | 148 |
| ,, | Dougarie Lodge | 4·91 | ... | *Lim.* | Foynes, Coolnanes | 5·37 | 208 |
| *Arg.* | Ardgour House | 7·30 | ... | ,, | Castleconnell Rec. | 4·47 | ... |
| ,, | Manse of Glenorchy | 6·65 | ... | *Clare* | Inagh, Mount Callan | 7·54 | ... |
| ,, | Oban | 4·73 | ... | ,, | Broadford, Hurdlest'n. | 4·79 | ... |
| ,, | Poltalloch | 3·98 | 131 | *Wexf* | Newtownbarry | 3·75 | ... |
| ,, | Inveraray Castle | 6·52 | 165 | ,, | Gorey, Courtown Ho. | 3·42 | 141 |
| ,, | Islay, Eallabus | 4·65 | 178 | *Kilk.* | Kilkenny Castle | 2·91 | 120 |
| ,, | Mull, Benmore | 9·20 | ... | *Wic.* | Rathnew, Clonmannon | 3·21 | ... |
| *Kinr.* | Loch Leven Sluice | 3·38 | 154 | *Carl.* | Hacketstown Rectory | ... | ... |
| *Perth* | Loch Dhu | 6·90 | 161 | *QCo.* | Blandsfort House | 3·64 | 141 |
| ,, | Balquhidder, Stronvar. | 4·78 | ... | ,, | Mountmellick | 3·49 | ... |
| ,, | Crieff, Strathearn Hyd. | 4·80 | 182 | *KCo.* | Birr Castle | 2·78 | 120 |
| ,, | Blair Castle Gardens | 2·61 | 132 | *Dubl.* | Dublin, FitzWm. Sq. | 2·49 | 128 |
| *Forf.* | Kettins School | 2·54 | 136 | ,, | Balbriggan, Ardgillan | 2·26 | 112 |
| ,, | Dundee, E. Necropolis | 2·53 | 141 | *Me'th* | Beaupare, St. Cloud | 2·58 | ... |
| ,, | Pearsie House | 4·13 | ... | ,, | Kells, Headfort | 2·32 | 88 |
| ,, | Montrose, Sunnyside | 2 88 | 173 | *W.M* | Moate, Coolatore | 2·50 | ... |
| *Aber.* | Braemar, Bank | 3·63 | 185 | ,, | Mullingar, Belvedere | 2·31 | 89 |
| ,, | Logie Coldstone Sch. | 3·76 | 193 | *Long* | Castle Forbes Gdns. | 3·11 | 121 |
| ,, | Aberdeen, King's Coll. | 2·54 | 149 | *Gal.* | Ballynahinch Castle | 5·58 | 158 |
| ,, | Fyvie Castle | 3·62 | ... | ,, | Galway, Grammar Sch. | ... | ... |
| *Mor.* | Gordon Castle | 4·16 | 204 | *Mayo* | Mallaranny | 5·00 | ... |
| ,, | Grantown-on-Spey | 4·09 | 182 | ,, | Westport House | 4·09 | 151 |
| *Na.* | Nairn, Delnies | 3·51 | 199 | ,, | Delphi Lodge | 7·38 | ... |
| *Inv.* | Ben Alder Lodge | 3·81 | ... | *Sligo* | Markree Obsy. | 3·32 | 110 |
| ,, | Kingussie, The Birches | 2·63 | ... | *Cav'n* | Belturbet, Cloverhill. | 3·36 | 138 |
| ,, | Loch Quoich, Loan | 9·75 | ... | *Ferm* | Enniskillen, Portora | 3·56 | ... |
| ,, | Glenquoich | 8·95 | 182 | *Arm.* | Armagh Obsy. | 2·91 | 115 |
| ,, | Inverness, Culduthel R. | 2·76 | ... | *Down* | Fofanny Reservoir | 4·98 | ... |
| ,, | Arisaig, Faire-na-Squir | 3·50 | ... | ,, | Seaforde | 3·34 | 121 |
| ,, | Fort William | 5·71 | 159 | ,, | Donaghadee, C. Stn. | 3·58 | 154 |
| ,, | Skye, Dunvegan | 3·76 | ... | ,, | Banbridge, Milltown | 4·54 | 177 |
| ,, | Barra, Castlebay | ... | ... | *Antr.* | Belfast, Cavehill Rd. | 4·47 | ... |
| *R&C* | Alness, Ardross Cas. | 3·44 | 152 | ,, | Glenarm Castle | 3·56 | ... |
| ,, | Ullapool | 4·41 | ... | ,, | Ballymena, Harryville | 4·42 | 152 |
| ,, | Torridon, Bendamph. | 6·32 | 155 | *Lon.* | Londonderry, Creggan | 3·85 | 136 |
| ,, | Achnashellach | 6·49 | ... | *Tyr.* | Donaghmore | 3·84 | ... |
| ,, | Stornoway | 3·76 | 162 | ,, | Omagh, Edenfel | 3·54 | 125 |
| *Suth.* | Lairg | 3·24 | ... | *Don.* | Malin Head | 3·78 | 177 |
| ,, | Tongue Manse | 4·49 | 219 | ,, | Dunfanaghy | 3·68 | 129 |
| ,, | Melvich School | 3·35 | 173 | ,, | Killybegs, Rockmount | ... | ... |

## Climatological Table for the British Empire, January, 1927

| STATIONS | PRESSURE | | TEMPERATURE | | | | | | | Relative Humidity | Mean Cloud Am'nt | PRECIPITATION | | | BRIGHT SUNSHINE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Absolute | | Mean Values | | | | Mean | | | | | | | |
| | Mean of Day M.S.L. | Diff. from Normal | Max. | Min. | Max. | Min. | ½ max. and min. | Diff. from Normal | Wet Bulb. | | | Am'nt | Diff. from Normal | Days | Hours per day | Percentage of possible. |
| | mb. | mb. | °F. | °F. | °F. | °F. | °F. | °F. | °F. | % | 0—10 | in. | in. | | | |
| London, Kew Obsy. | 1010·0 | − 7·6 | 53 | 26 | 45·9 | 36·0 | 40·9 | + 2·0 | 37·8 | 89 | 6·1 | 1·91 | + 0·15 | 19 | 1·7 | 17 |
| Gibraltar | 1023·7 | + 2·5 | 70 | 42 | 60·6 | 48·5 | 54·5 | − 0·3 | 49·0 | 82 | 4·3 | 2·28 | − 2·78 | 12 | ... | ... |
| Malta | 1016·4 | − 1·2 | 64 | 45 | 58·5 | 51·4 | 54·9 | − 0·4 | 50·9 | 79 | 6·2 | 1·77 | − 1·44 | 15 | 5·4 | 55 |
| St. Helena | 1011·5 | + 1·6 | 69 | 57 | 65·0 | 59·1 | 62·1 | − 2·4 | 59·8 | 93 | 3·6 | 1·63 | − 1·34 | 17 | ... | ... |
| Sierra Leone | 1011·1 | + 0·3 | 90 | 66 | 87·9 | 72·2 | 80·1 | − 1·2 | 70·8 | 65 | 2·4 | 0·00 | − 0·41 | 0 | ... | ... |
| Lagos, Nigeria | 1008·2 | − 1·7 | 91 | 68 | 87·5 | 72·3 | 79·9 | − 1·0 | 71·2 | 77 | 7·8 | 2·49 | + 1·42 | 3 | ... | ... |
| Kaduna, Nigeria | ... | ... | 97 | 51 | 87·4 | 57·6 | 72·5 | − 0·9 | 53·8 | 25 | ... | 0·00 | 0 | 0 | ... | ... |
| Zomba, Nyasaland | 1007·7 | + 0·3 | 86 | ... | 81·8 | ... | ... | ... | ... | 81 | 8·1 | 11·39 | + 0·93 | 17 | ... | ... |
| Salisbury, Rhodesia | 1007·5 | − 0·8 | 88 | 49 | 80·9 | 59·1 | 70·0 | + 0·3 | 62·9 | 65 | 5·3 | 3·84 | − 3·63 | 9 | 7·9 | 60 |
| Cape Town | 1013·6 | + 0·2 | 97 | 53 | 82·3 | 62·1 | 72·2 | + 2·3 | 64·1 | 68 | 2·2 | 0·18 | − 0·52 | 2 | ... | ... |
| Johannesburg | 1010·3 | + 0·7 | 93 | 45 | 80·6 | 57·0 | 68·8 | + 2·3 | 60·0 | 67 | 3·1 | 5·01 | − 1·16 | 14 | 8·0 | 59 |
| Mauritius | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Bloemfontein | ... | ... | 102 | 49 | 90·5 | 61·6 | 76·1 | + 2·9 | 61·7 | 49 | 2·4 | 2·56 | − 1·46 | 8 | ... | ... |
| Calcutta, Alipore Obsy. | 1014·7 | − 0·5 | 85 | 49 | 77·4 | 58·2 | 67·8 | + 1·4 | 59·3 | 89 | 4·6 | 0·35 | 0 | 1* | ... | ... |
| Bombay | 1012·1 | − 1·5 | 85 | 63 | 81·3 | 66·6 | 73·9 | − 1·4 | 63·1 | 71 | 1·6 | 0·00 | − 0·10 | 0* | ... | ... |
| Madras | 1013·0 | − 1·1 | 88 | 63 | 85·5 | 68·3 | 76·9 | + 0·8 | 72·3 | 87 | 5·5 | 0·57 | − 0·82 | 2* | ... | ... |
| Colombo, Ceylon | 1010·0 | − 1·5 | 90 | 67 | 86·5 | 72·3 | 79·4 | + 0·3 | 75·2 | 76 | 5·9 | 5·66 | + 2·16 | 9 | 7·4 | 63 |
| Hongkong | 1019·0 | − 0·8 | 75 | 47 | 64·2 | 56·3 | 60·3 | + 0·1 | 55·4 | 73 | 7·4 | 0·31 | − 1·06 | 3 | 4·4 | 41 |
| Sandakan | ... | ... | 89 | 74 | 85·9 | 75·4 | 80·7 | + 0·9 | 76·7 | 85 | ... | 15·45 | − 3·00 | 17 | ... | ... |
| Sydney | 1013·1 | + 0·6 | 90 | 56 | 77·0 | 64·5 | 70·7 | − 1·0 | 66·2 | 70 | 6·7 | 4·11 | + 0·38 | 14 | 6·7 | 48 |
| Melbourne | 1014·1 | + 1·2 | 106 | 48 | 79·7 | 58·0 | 68·9 | + 1·4 | 59·7 | 55 | 6·0 | 0·60 | − 1·25 | 6 | 7·9 | 55 |
| Adelaide | 1013·5 | + 0·5 | 110 | 51 | 87·3 | 62·1 | 74·7 | + 0·8 | 60·1 | 31 | 3·9 | 0·27 | − 0·46 | 3 | 10·5 | 74 |
| Perth, W. Australia | 1011·5 | − 1·0 | 102 | 53 | 82·6 | 60·2 | 71·4 | − 2·5 | 62·7 | 56 | 3·0 | 0·47 | + 0·13 | 6 | 10·8 | 78 |
| Coolgardie | 1012·6 | + 1·2 | 111 | 49 | 89·8 | 59·3 | 74·5 | − 2·9 | 58·4 | 40 | 3·1 | 0·71 | + 0·24 | 3 | ... | ... |
| Brisbane | 1011·7 | + 0·4 | 88 | 65 | 81·9 | 68·8 | 75·3 | − 1·9 | 70·8 | 75 | 6·9 | 22·43 | +16·16 | 19 | 6·8 | 49 |
| Hobart, Tasmania | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Wellington, N.Z. | 1017·5 | + 4·2 | 81 | 44 | 70·5 | 56·6 | 63·5 | + 1·0 | 59·3 | 65 | 5·2 | 0·68 | − 2·65 | 9 | 7·7 | 52 |
| Suva, Fiji | 1006·4 | − 1·3 | 91 | 70 | 85·6 | 74·1 | 79·9 | 0·0 | 75·8 | 83 | 7·9 | 31·61 | +20·89 | 27 | 3·8 | 29 |
| Apia, Samoa | 1009·3 | + 1·4 | 89 | 71 | 84·9 | 74·8 | 79·9 | + 0·9 | 77·5 | 81 | 7·1 | 28·80 | +11·99 | 26 | 5·1 | 40 |
| Kingston, Jamaica | 1015·5 | + 0·4 | 89 | 62 | 85·3 | 67·9 | 76·6 | − 0·2 | 66·3 | 87 | 4·6 | 0·07 | − 0·89 | 3 | 9·0 | 80 |
| Grenada, W.I. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Toronto | 1021·6 | + 4·2 | 44 | −17 | 28·1 | 14·6 | 21·3 | − 0·8 | 17·9 | 75 | 6·8 | 1·57 | − 1·30 | 14 | 2·9 | 31 |
| Winnipeg | 1021·7 | + 1·9 | 38 | −32 | 9·0 | − 4·8 | 2·1 | + 6·5 | − 0·9 | 76 | 3·9 | 0·35 | − 0·47 | 5 | 4·2 | 49 |
| St. John, N.B. | 1016·4 | + 0·7 | 46 | − 9 | 30·3 | 17·1 | 23·7 | + 4·5 | 20·0 | 81 | 6·1 | 4·62 | − 0·18 | 15 | 2·7 | 30 |
| Victoria, B.C. | 1016·3 | + 1·0 | 51 | 21 | 42·6 | 37·0 | 39·8 | − 0·3 | 37·1 | 81 | 8·5 | 2·62 | − 1·89 | 15 | 1·8 | 21 |

*For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| St. John, N.B. | 1016·4 | + 0·7 | 46 | — 9 | 30·3 | 17·1 | 23·7 | + 4·5 | 20·0 | 81 | 6·1 | 4·62 | — 0·18 | 15 | 2·2 | 45 |
| Victoria, B.C. | 1016·3 | + 1·0 | 51 | 21 | 42·6 | 37·0 | 39·8 | — 0·3 | 37·1 | 81 | 8·5 | 2·62 | — 1·89 | 15 | 1·8 | 21 |

*For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.